

**ALAGAPPA UNIVERSITY, KARAIKUDI**  
**NEW SYLLABUS UNDER CBCS PATTERN (w.e.f. 2017-18)**

**B.Sc. BIOCHEMISTRY – PROGRAMME STRUCTURE**

| Sem | Part                         | Course Code   | Title of the Course   | Cr.  | Hrs./ Week | Marks |            |            |     |
|-----|------------------------------|---|---|--|------------|-------|------------|------------|-----|
|     |                              |   |   |  |            | Int.  | Ext.       | Total      |     |
| 1   | 1                            | 711T  | Tamil / Other Languages – 1   | 3  | 6          | 25    | 75         | 100        |     |
|     | 11                           | 712E  | English – 1   | 3  | 6          | 25    | 75         | 100        |     |
|     | 111                          |   | 7BBC1C1   | Core – 1 – Bio-Molecules                                   | 4          | 4     | 25         | 75         | 100 |
|     |                              |   | 7BBC1C2   | Core – 11 – Cell Biology                                   | 4          | 5     | 25         | 75         | 100 |
|     |                              |   | ---   | Core – 111 – Laboratory course 1 – Analytical Biochemistry | -          | 3*    | -          | -          | -   |
|     |                              |   | Allied – 1 (Theory only) (or)   | 5  | 5          | 25    | 75         | 100        |     |
|     |                              |   | Allied – 1 (Theory cum Practical)   | 4  | 3          | 15    | 60         | 75         |     |
|     |                              |   | Allied Practical – 1  | --   | 2**        | --    | --         | --         |     |
|     | 1U                           | 7NMÉ1A/<br>7NMÉ1B/<br>7NMÉ1C  | (1) Non-Major Elective – 1 (A) jkpo; nkhopapd; mbg;gilfs;/ (B) f;fhy ,yf;fpak;/ (C) Communicative English | 2  | 1          | 25    | 75         | 100        |     |
|     |                              |   | <b>Total(Allied -Theory only)</b>   | <b>21</b>  | <b>30</b>  | -     | -          | <b>600</b> |     |
|     |                              | <b>Total(Allied -Theory cum Practical)</b>  | <b>20</b>   | -  |            | -     | <b>575</b> |            |     |
| 11  | 1                            | 721T  | Tamil/other languages – 11  | 3  | 6          | 25    | 75         | 100        |     |
|     | 11                           | 722E  | English – 11  | 3  | 6          | 25    | 75         | 100        |     |
|     | 111                          |   | 7BBC2P1   | Core – 111 – Laboratory Course 1 – Analytical Biochemistry | 4          | 3     | 40         | 60         | 100 |
|     |                              |   | 7BBC2C1   | Core – 1U – Analytical Biochemistry                        | 4          | 4     | 25         | 75         | 100 |
|     |                              |   | 7BBC2C2   | Core – U Intermediatory Metabolism                         | 4          | 4     | 25         | 75         | 100 |
|     |                              |   | Allied – 11 (Theory only) (or)  | 5  | 5          | 25    | 75         | 100        |     |
|     |                              |   | Allied – 11 (Theory cum Practical)  | 4  | 3          | 15    | 60         | 75         |     |
|     |                              |   | Allied Practical – 1  | 2  | 2          | 20    | 30         | 50         |     |
| 1U  | 7BES2                        | (3) Environmental Studies   | 2   | 2  | 25         | 75    | 100        |            |     |
|     |                              | <b>Total (Allied-Theory only)</b>   | <b>25</b>   | <b>30</b>  | -          | -     | <b>700</b> |            |     |
|     |                              | <b>Total(Allied-Theory cum Practical)</b>   | <b>26</b>   |  | -          | -     | <b>725</b> |            |     |
| 111 | 1                            | 731T  | Tamil /other languages – 111  | 3  | 6          | 25    | 75         | 100        |     |
|     | 11                           | 732E  | English – 111   | 3  | 6          | 25    | 75         | 100        |     |
|     | 111                          |   | 7BBC3C1   | Core – U1 – Enzymology                                     | 4          | 5     | 25         | 75         | 100 |
|     |                              |   | ---   | Core – U11 – Laboratory course 11 – Biochemistry Technique | -          | 5*    | --         | --         | --- |
|     |                              |   | Allied – 111 (Theory only) (or)   | 5  | 5          | 25    | 75         | 100        |     |
|     |                              |   | Allied – 111 (Theory cum Practical)   | 4  | 3          | 15    | 60         | 75         |     |
|     |                              |   | Allied Practical – 11   | --   | 2**        | --    | --         | ---        |     |
| 1U  | 7NMÉ3A/<br>7NMÉ3B/<br>7NMÉ3C | (1) Non-major Elective – 11 (A),yf;fpaKk; nkhopg; gad;gh1k;/ (B) goe;jkpo; ,yf;fpaq;fSk; ,yf;fpatuyhWk;/ (C) Effective Employability Skills | 2   | 1  | 25         | 75    | 100        |            |     |

|    |                     |  |  |                                     |           |           |           |            |
|----|---------------------|--|--|-------------------------------------|-----------|-----------|-----------|------------|
|    |                     | 7SBS3A1/<br>7SBS3A2/<br>7SBS3A3  | <b>(2) Skill Based Subjects – 1</b>  | 2                                   | 2         | 25        | 75        | 100        |
|    | U                   | 7BEA3  | <b>Extension activities</b>  | 1                                   | -         | 100       | --        | 100        |
|    |                     |  | <b>Total(Allied-Theory only)</b>   | <b>20</b>                           | <b>30</b> | <b>-</b>  | <b>-</b>  | <b>700</b> |
|    |                     |  | <b>Total(Allied-Theory cum Practical)</b>  | <b>19</b>                           |           |           |           | <b>675</b> |
|    | 1                   | 741T   | <b>Tamil /other languages – 1U</b>   | 3                                   | 6         | 25        | 75        | 100        |
|    | 11                  | 742E   | <b>English – 1U</b>  | 3                                   | 6         | 25        | 75        | 100        |
| 1U | 111                 | 7BBC4P1  | <b>Core – 111 – Laboratory Course 11 – Biochemistry Technique</b>                  | 4                                   | 4         | <b>40</b> | <b>60</b> | 100        |
|    |                     | 7BBC4C1  | <b>Core – 1111 – Human Physiology</b>  | 4                                   | 5         | 25        | 75        | 100        |
|    |                     |  | <b>Allied – 1U (Theory only) (or)</b>  | 5                                   | 5         | 25        | 75        | 100        |
|    |                     |  | <b>Allied – 1U (Theory cum Practical)</b>  | 4                                   | 3         | 15        | 60        | 75         |
|    |                     |  | <b>Allied Practical – 11</b>   | 2                                   | 2         | 20        | 30        | 50         |
|    | 1U                  | 7SBS4B1/<br>7SBS4B2/<br>7SBS4B3  | <b>(2) Skill Based Subjects – 11</b>   | 2                                   | 2         | 25        | 75        | 100        |
|    |                     | 7BUE4/<br>7BMY4/<br>7BWS4  | <b>(4) Value Education / Manavalakalai Yoga / Women's Studies</b>                  | 2                                   | 2         | 25        | 75        | 100        |
|    |                     |  | <b>Total(Allied-Theory only)</b>   | <b>23</b>                           | <b>30</b> | <b>-</b>  | <b>-</b>  | <b>700</b> |
|    |                     |  | <b>Total(Allied-Theory cum Practical)</b>  | <b>24</b>                           |           |           |           | <b>725</b> |
| U  | 111                 | 7BBC5C1  | <b>Core – 1X – Molecular Biology</b>   | 4                                   | 5         | 25        | 75        | 100        |
|    |                     | 7BBC5C2  | <b>Core – X – Clinical Biochemistry</b>  | 4                                   | 5         | 25        | 75        | 100        |
|    |                     | 7BBC5C3  | <b>Core – X1 – Human Genetics</b>  | 4                                   | 5         | 25        | 75        | 100        |
|    |                     | -----  | <b>Core – X11 – Laboratory Course 111 – Basic Microbiology and Immunology</b>      | -                                   | 3*        | --        | --        | ---        |
|    |                     | -----  | <b>Core – X111 – Laboratory Course 1U – Basic Clinical Biochemistry</b>            | -                                   | 3*        | --        | --        | ---        |
|    | 7BBCE1A/<br>7BBCE1B | <b>Elective – 1 – A) Microbiology &amp; Immunology (or) B) Diagnostic Biochemistry</b> | 5  | 5                                   | 25        | 75        | 100       |            |
|    | 1U                  |  | 7SBS5A4/<br>7SBS5A5/<br>7SBS5A6/<br>7SBS5A7  | <b>(2) Skill Based Subjects – 1</b> | 2         | 2         | 25        | 75         |
|    |                     |  | <b>(2) Skill Based Subjects – 1</b>  | 2                                   | 2         | 25        | 75        | 100        |
|    |                     |  | <b>Total</b>   | <b>21</b>                           | <b>30</b> | <b>--</b> | <b>--</b> | <b>600</b> |
| U1 | 111                 | 7BBC6P1  | <b>Core – X11 – Laboratory course 111 – Basic Microbiology and Immunology</b>      | 4                                   | 3         | <b>40</b> | <b>60</b> | 100        |
|    |                     | 7BBC6P2  | <b>Core – X111 – Laboratory Course 1U – Basic Clinical Biochemistry</b>            | 4                                   | 3         | <b>40</b> | <b>60</b> | 100        |
|    |                     | 7BBC6C1  | <b>Core – X1U – Nutrition Biochemistry</b>   | 4                                   | 5         | 25        | 75        | 100        |
|    |                     | 7BBC6C2  | <b>Core – XU – Plant Biochemistry</b>  | 4                                   | 5         | 25        | 75        | 100        |
|    |                     | 7BBCE2A/<br>7BBCE2B  | <b>Elective – 11 – A) Biotechnology (or) B) Drug Biochemistry</b>                  | 5                                   | 5         | 25        | 75        | 100        |
|    |                     | 7BBCE3A/<br>7BBCEPR  | <b>Elective – 111 – A) Biostatistics &amp; Bioinformatics (or) B) Mini Project</b> | 5                                   | 5         | 25        | 75        | 100        |

|                    |   |                               |            |            |           |           |             |
|--------------------|---|-------------------------------|------------|------------|-----------|-----------|-------------|
| 7U                 | 7SBS6B4/<br>7SBS6B5/<br>7SBS6B6/<br>7SBS6B7 | (2) Skill Based Subjects – 77 | 2          | 2          | 25        | 75        | 100         |
|                    |   | (2) Skill Based Subjects – 77 | 2          | 2          | 25        | 75        | 100         |
| <b>Total</b>       |   |                               | <b>30</b>  | <b>30</b>  | <b>--</b> | <b>--</b> | <b>800</b>  |
| <b>Grand Total</b> |   |                               | <b>140</b> | <b>180</b> | <b>--</b> | <b>--</b> | <b>4100</b> |

**\*\* University Examinations will be held in the even semester  
B.Sc. BIOCHEMISTRY**

**1 YEAR – 1 SEMESTER  
COURSE CODE: 7BBC1C1**

### **CORE COURSE- 1 – BIO-MOLECULES**

#### **Unit 1 GENERAL INTRODUCTION**

Structure of atoms and molecules - chemical bonds such as Van der Waals, electrostatic, hydrogen and covalent bond. Properties of water- its importance for living organisms. Acid and bases- Lewis concept of acid and bases, titrable acidity, pH, pOH, buffer, pH of body fluids, buffer in body fluids, Red blood cells, white blood cells, tissues and its role. Measurement of pH by indicator and glass electrode.

#### **Unit 11 CARBOHYDRATES**

**Monosaccharides:** Definition, Classification, Structure of Open - Chain, Haworth and Fischer formula, Stereoisomerism, Optical isomerism, Reactions of functional groups of sugars: Aldehyde, Keto and Hydroxyl groups.

**Di, Tri, and Oligosaccharides:** Occurrence, Composition, Structure and Biological role of Sucrose, Lactose, Maltose, Raffinose.

**Polysaccharides:** Occurrence, Composition, Structure and Biological role of Cellulose, Chitin, Inulin, Starch, Glycogen.,

#### **Unit 111 PROTEINS**

Chemistry of monomeric units of proteins: Classification of Amino acids based on its side chains, Structure of Amino acids, Zwitterion, pKa and Optical properties of amino acids. Essential amino acids. Isoelectric pH, acid base properties of amino acids. Formation of peptide bond

Structure: Hierarchical structure of proteins: Primary structure – peptide bond and its characteristics, Secondary structure – alpha-helix and Beta-pleated sheets, Tertiary structure: Myoglobin, Quaternary structure – Hemoglobin.

#### **Unit 111 LIPIDS**

Lipids: Definition and classification. Fatty acids: introduction, classification, nomenclature, structure and properties of saturated and unsaturated fatty acids. Essential fatty acids. Triacylglycerols: nomenclature, physical properties, chemical properties and characterization of fats - hydrolysis, saponification value, acid value, rancidity of fats, Reichert-Meissel number. Glycerolipids, glycerophospholipids, sphingolipids, sterol lipids.

## **Unit V            NUCLEIC ACIDS AND VITAMINS**

**Nucleic acids:** Bases, nucleosides and nucleotides, polynucleotide. Structure, types and biological role of DNA and RNA

**Vitamins:** Source, Structure, deficiency diseases and biochemical functions of water soluble and fat soluble vitamins and their coenzyme activity.

### **Text Books:**

1. *Biochemistry* by N.Arumugam, Saras Publications, 3rd edition (2010) (For Unit 1, 2 & 3)
2. *Biochemistry* by U.Sathyanarayana, Allied Books Publishers, 4th edition, 2007, (For Unit 4 & 5)

### **Books for Reference:**

1. *Biochemistry* (4<sup>th</sup> Edition) – Geoffrey Zubay
2. *Biochemistry* – Stryer
3. *Principles of Biochemistry* – Lehninger
4. *Herper's Biochemistry*
5. *Fundamentals of Biochemistry* – Voet & Voet
6. *Fundamentals of Biochemistry* – J.L. Jain
7. *Biochemistry* (2<sup>nd</sup> Edition) – Ian D.K. Halkerston
8. *Nucleic acids: Structure, Properties and Functions* – Victor A. Bloomfield
9. *Biochemistry* by Lubert Stryer, Free man Publishers Ltd, 5<sup>th</sup> edition (2002)
10. *Biochemistry* by Voet & Voet, Wiley Publications, 2<sup>nd</sup> Edition (2003)



**1 YEAR – 1 SEMESTER  
COURSE CODE: 7BBC1C2**

**CORE COURSE- 11 - CELL BIOLOGY**

**Unit I Structure and molecules of Cells**

Characteristic features of prokaryote and eukaryotes, Structure of eukaryotic cells, Structure of Plasma membrane - phospho lipid bilayer and Fluid mosaic model; Functions of plasma membrane- transport of small molecules - passive diffusion, facilitated diffusion and carrier proteins. Ion channels; Active transport driven by ATP and Ion gradients. Membrane lipids and membrane proteins; Composition of the Cell- Carbohydrate, Lipid, Nucleic acids and Proteins. Cytoplasmic matrix and chemical composition of cytosol.

**Unit II Structure and functions of cell organelles**

Morphology; ultrastructure and functions of Endoplasmic Reticulum (ER), Golgi apparatus, Cytoskeleton, Vesicle, Ribosome, Lysosome, Microbodies, Peroxisomes and Glyoxysomes, centrioles, Cilia, flagella, Mitochondria, Nucleus and nucleolus.

**Unit III Nucleic acids and Organization**

Internal organization of nucleus, Chromosomes- ultrastructure, composition and karyotyping single stranded and multi stranded hypotheses, folded-fibre model and nucleosome concept, nucleosome and solenoid model of chromatin, solenoid models, functions ; giant chromosomes - polytene chromosomes, lampbrush chromosomes. DNA replication, Central dogma- Transcription and translation.

**Unit IV Metabolism, cell division and growth**

Cell metabolism-catalytic activity of enzymes, metabolic energy, functions of adenosine triphosphate (ATP); oxidation of carbohydrates - glycolysis, oxidative decarboxylation, Krebs cycle, respiratory chain and oxidative phosphorylation.

Cell cycle and mitosis - general events of interphase, prophase, metaphase, anaphase, telophase, Meiosis- kinds of meiosis, process of meiosis, heterotypic division or first meiotic division, homotypic or second meiotic division significance of mitosis; meiosis.

**Unit V Cancer**

The Biology of Cancer, types, causes; properties of cancer cells; Genetics of cancer- Role and identification of tumor suppressor genes and oncogenes. Functions of tumor suppressor gene and oncogenes products; Apoptosis and cancer.

**Books for Reference:**

1. *The Cell: A Molecular Approach, Fourth Edition (2007) By Geoffrey M. Cooper and Robert E. Hausman.*
2. *Cell And Molecular Biology: Concepts And Experiments, 6th Edition (2010) By Gerald Karp.*
3. *Molecular Biology of The Cell, Fourth Edition (2002) By Bruce Alberts Et Al.,*
4. *Cell Biology, Genetics, Molecular Biology, Evolution And Ecology (2005) By P.S. Verma And U.K. Agarwal.*



**1 YEAR – 1<sup>ST</sup> SEMESTER  
COURSE CODE: 7BBC2P1**

**CORE COURSE - 111 – LABORATORY COURSE – 1 –  
ANALYTICAL BIOCHEMISTRY  
(University Examination will be held in the second semester only)**

1. Preparation of Buffers- Phosphate, Acetate and Citrate
2. Determination of pH of Buffer Solution using Indicators and pH meter
3. Titration Curve of Amino acids
4. Verification of Beer – Lambert's Law
5. Qualitative Analysis of Biomolecules
  - i. Qualitative Analysis of Carbohydrates
    - Monosaccharide's :- Pentose, Glucose, Fructose, Mannose
    - Disaccharides :- Sucrose, Maltose, Lactose
    - Polysaccharides :- Starch, Dextrin and Glycogen
  - ii. Qualitative Analysis of Lipids
  - iii. Qualitative Analysis of Amino acids and Proteins
    - Aliphatic :- Histidine, Arginine, & Proline
    - Aromatic:- Tyrosine, Tryptophan, Phenylalanine
    - Sulphur containing aminoacids:- cystein, cystine & methionine
6. Biochemical Preparation
  - i. Starch from Potato
  - ii. Casein from Milk
7. Separation of Amino Acids by Circular Chromatography
8. Isolation of glycogen from goat liver



**1 YEAR – 11 SEMESTER  
COURSE CODE: 7BBC2C1**

**CORE COURSE - 11- ANALYTICAL BIOCHEMISTRY**

**Unit I CENTRIFUGATION**

*Basic principles: Sedimentation principle, relative centrifugal force, revolutions per minute, RCF Vs RPM, G-force; types of rotors; Preparative and analytical centrifuges; -- Density gradient centrifugation; Application of analytical ultra centrifuge; Swedberg value; safety aspects in the ultra centrifuge.*

**Unit II CHROMATOGRAPHY**

*General principles - column, paper and thin layer chromatography - Adsorption - Affinity - Ion exchange - Exclusion - Gas - Liquid Chromatography and HPLC. Application and selection of chromatography method for biology.*

**Unit III ELECTROPHORESIS**

*Theory of electrophoresis, types of electrophoresis: moving boundary and zone electrophoresis, paper electrophoresis, cellulose acetate strip and polyacrylamide gel electrophoresis. SDS-PAGE- vertical and horizontal electrophoresis and their applications. Agarose gel electrophoresis and its applications. Isoelectric focusing- theory and applications.*

**Unit IV COLORIMETRY AND SPECTROPHOTOMETRY**

*Beer-Lambert law and its limitations, Light absorption and transmission, Extinction coefficient. UV and visible absorption spectroscopy, Fourier Transform Infra red spectroscopy, Atomic absorption spectrophotometer. Biochemical applications of spectrophotometers. Principle and Application of fluorimetry.*

**Unit V NUCLEAR CHEMISTRY**

*Radio isotopes, units of radio activity, half life, and - emitters. Detection and measurement of radioactivity - Methods based upon ionization - GM counter, excitation - Scintillation counter. Autoradiography - Application of radio isotopes in the elucidation of metabolic pathways, clinical scanning and radio dating, radio immuno assay. Biological hazards of radiation and safety measures in handling radio isotopes.*

**Text Books:**

1. *Analytical Biochemistry* by P.Asokan, Chinna Publications, 2nd edition, (2005) (For Unit 1, 2 & 3)
2. *Biophysical chemistry - Principles and Techniques* by Upathayaye and Nath, Himalaya Publishers, 3rd edition, (2002) (For Unit 4 & 5)



**Books for Reference:**

1. *Practical Biochemistry – Wilson & Walker*
2. *Instrumental Analysis using Spectroscopy – Melon*
3. *A biologist's Guide to Principles and Techniques of Practical Biochemistry – Wilson & Goulding*
4. *Hand Book of Instrumental techniques for analytical chemist – Frank Settle.*
5. *Biochromatography Theory and Practice – M.A. Vijayalakshmi*
6. *Principles and techniques of practical Biochemistry by Wilson and Walker University Press, Cambridge, 5<sup>th</sup> editon (2000)*



**1 YEAR – 11 SEMESTER  
COURSE CODE: 7BBC2C2**

**CORE COURSE - V – INTERMEDIATORY METABOLISM**

**Unit 1 CARBOHYDRATE METABOLISM**

*Glycolysis – aerobic and anaerobic, energetic of glycolysis. TCA cycle – amphibolic nature, energetics of TCA cycle. Glyoxalate cycle. Pentose phosphate pathway. Glycogenesis. Glycogenolysis. Gluconeogenesis and cori cycle (in liver)*

**Unit 11 BIOENERGETICS**

*Introduction to bioenergetics. High energy compounds (ATP, phosphocreatinine, phosphoenol pyruvate, glucose-6-phosphate). Exergonic and endergonic reactions. Role of ATP/ADP cycle in transfer of high-energy phosphate. Substrate-level phosphorylation Mitochondrion: Structure of mitochondrial membranes, Mitochondrial enzymes. Electron transport chain and oxidative phosphorylation – Theories of ATPase- Uncouplers of oxidative phosphorylation.*

**Unit 111 AMINO ACID METABOLISM**

*A brief account of amino acid metabolism: Glucogenic and ketogenic amino acids -Deamination, Transamination. Metabolism of glucogenic (glycine, cysteine, proline); ketogenic (leucine, lysine) and both glucogenic and ketogenic amino acids (phenylalanine) , Reactions of Urea cycle and its disorders.*

**Unit 111 LIPID METABOLISM**

*Oxidation of fatty acids: Even number carbon atoms, , and oxidations, energetic of -oxidation – ketone body metabolism, glycerol metabolism – biosynthesis of fatty acids, Triglycerides and Phospholipids. Cholesterol metabolism.*

**Unit V NUCLEIC ACID METABOLISM**

*Structures of purines and pyrimidines. Biosynthesis and catabolism of nucleotides – Biosynthesis of nucleotide coenzymes – inhibitors of nucleotide biosynthesis*

**Text Books:**

1. *Understanding enzymes by Trevor Palmer, Prentice Hall Publishers, 4th edition (1997) (For Unit 1, 2 &3)*
2. *Enzymes by P.Asokan, Chinna publications , 2nd edition, (2005) (For unit 4 & 5)*
3. *Biochemistry by Harper, Mc Graw Hill publishers, 25th edition(2003)(For Unit 1,2 & 3)*
4. *Biochemistry by U.Satyanarayana, Allied Book Publishers, 3rd edition (2006) (For Unit 4 & 5).*

**Books for Reference:**

1. *Fundamentals of Biochemistry – Voet & Voet*

2. *Principles of Biochemistry* – Lehninger
3. *Biochemistry* – Stryer
4. *Biochemistry* – Zubay
5. *Herper's Biochemistry (25<sup>th</sup> Edition)*
6. *Textbook of Biochemistry* – Devlin
7. *Enzymes by Dixon and webb, Academic Press, New York (1982)*
8. *Fundamentals of Biochemistry by J.L.Jain, S.Chand & Company Ltd, 4th edition (2005).*
9. *Biochemistry by S.Nagini, Scitech Publications (2007)*



**11 YEAR – 111 SEMESTER  
COURSE CODE: 7BBC3C1**

**CORE COURSE- V1 – ENZYMOLOGY**

**Unit 1 INTRODUCTION**

History, general characteristics, nomenclature, IUB enzyme classification with examples, significance of numbering system. Definitions with examples of holoenzymes, oligomeric enzymes and multienzyme complexes. Enzyme specificity.

**Unit 11 ENZYME CATALYSIS**

Role of co-factors in enzyme catalysis: NAD/NADP<sup>+</sup>, FMN/FAD, CoA, biotin, lipoamide, TPP, pyridoxal phosphate, THF and metal ions with special emphasis on co-enzyme functions. Acid-base catalysis, covalent catalysis, proximity and orientation effects, strain and distortion theory. Mechanism of actions of chymotrypsin, carboxypeptidase, Ribonuclease and lysozyme.

**Unit 111 ENZYME KINETICS**

Enzyme kinetics – MM equation, LB plot, Eadie and Hofstee plot, Factors affecting enzyme activity, Enzyme catalysis – covalent catalysis, acid base catalysis. Bisubstrate reactions. Enzyme inhibition. Allosteric regulation.

**Unit 11V ENZYME PURIFICATION**

Importance of Enzyme purification. Strategies for purification- yield, catalytic activity and purity. Homogenization in enzyme purification; Techniques for separation – size based methods (centrifugation, size exclusion chromatography, dialysis, ultrafiltration), polarity based method (Ion-exchange chromatography), solubility based precipitation methods (change in pH, ionic strength, dielectric constant), ligand based method (ligand affinity chromatography)

**Unit V INDUSTRIAL AND CLINICAL APPLICATION OF ENZYMES**

Immobilization of enzymes and their industrial applications. Production of glucose from starch, cellulose and dextrin; use of lactase in dairy industry; production of glucose – fructose syrup from sucrose; use of proteases in food, detergent, leather and textile industry; medical application of enzymes; use of glucose oxidase in enzyme electrodes.

**Text Books:**

1. Understanding enzymes by Trevor Palmer, Prentice Hall Publishers, 4th edition (1997)(For Unit 1, 2 &3)
2. Enzymes by P.Asokan, Chinna publications , 2nd edition, (2005) (For unit 4 & 5)

**Books for Reference:**

1. Enzymes – Malcolm Dixon
2. Understanding of Enzymes – Trevor Palmer
3. Biochemistry – Geoffrey Zubay

4. *Biochemistry* – *Lubert Stryer*
5. *Enzymes by Dixon and webb, Academic Press, New York (1982)*



**11 YEAR – 111 / 11 SEMESTER  
COURSE CODE: 7BBC4P1**

**CORE COURSE - 111 – LABORATORY COURSE – 11 –  
BIOCHEMISTRY TECHNIQUE  
(University Examination will be held in fourth semester only)**

1. Estimation of Reducing Sugar by Dinitro salicylic acid method
2. Estimation of Protein by Lowry's method
3. Estimation of Free amino acids by Ninhydrin method
4. Estimation of Cholesterol by Zak's method
5. Estimation of DNA by Di-phenyl amine method
6. Estimation of RNA Orcinol method
7. Estimation of Haemoglobin by Drabkin's Method
8. Estimation of Iron by 2,2, Bipridyl method
9. Estimation of Vitamin 'C'
10. Estimation of Chlorophyll
11. Estimation of Cellulose.
12. Determination of Acid Number
13. Determination of Saponification Number
14. Determination of Total Activity of Salivary amylase
15. Determination of Total Activity of Alkaline Phosphatase



11 YEAR – 11 SEMESTER  
COURSE CODE: 7BBC4C1

CORE COURSE- 1111 – HUMAN PHYSIOLOGY

**Unit 1 BLOOD AND BODY FLUIDS**

Extra cellular fluid – plasma, interstitial fluid and transcellular fluid: Lymph and blood composition, functions, osmolarity of the body fluids, ionic composition, electrolytes and body buffers. Blood cells, hemoglobin, haemopoiesis, and coagulation and blood groups.

**Unit 11 DIGESTIVE SYSTEM**

Structure of digestive system. Composition, function and regulation of saliva, gastric, pancreatic, intestinal and bile secretions – digestion and absorption of carbohydrates, lipids, proteins, nucleic acids, minerals and vitamins.

**Unit 111 EXCRETORY SYSTEM**

Structure of nephron, formation of urine, glomerular filtration, tubular reabsorption of glucose, water and electrolyte balance – role of kidney and hormones in their maintenance.

**Unit 1111 ENDOCRINE SYSTEM**

A brief outline of various endocrine glands and their physiological roles; Biosynthesis, storage and secretion of both peptide and steroid hormones. Amino acids as hormones. Feed back regulation of hormone secretion, hormone receptors and their activation, mechanisms of intracellular and extra cellular hormone action.

**Unit 11111 RESPIRATORY SYSTEM**

Anatomy and physiology of respiration, exchange of gases between lung and blood and between blood and tissues. Role of lung and kidney in acid base balance. Acidosis and alkalosis.

**Text Books:**

1. Human Physiology by Chatterjee, Medical Allied Publications, 3rd edition, 2004 (for Unit 1 & 2)
2. Animal Physiology by N. Arumugam, Saras Publications, 2nd edition, 2008 (For Unit 3, 4 & 5)

**Books for Reference:**

1. Human Physiology: Vol. 1 & 11 – C.C. Chatterjee
2. Functions of the Human Body – Guyton, A.C.,
3. The living body – Best C.H. & Taylor N.B.
4. Human Physiology – Systemic & Applied – Sahalya
5. Human Physiology – Stuart Erafox
6. Human Physiology – Rhoades
7. Handbook of Physiology – Jefferson
8. Human Physiology by Guyton, Saunders Publishing Ltd, 9<sup>th</sup> edition (2004).
9. Physiology and Biochemistry by R.A. Agarwal, S.Chand Company Publishers, 3<sup>rd</sup> edition (1986)





**111 YEAR – V SEMESTER  
COURSE CODE: 7BBC5C1**

**CORE COURSE - 1X – MOLECULAR BIOLOGY**

**Unit I BASICS OF MOLECULAR BIOLOGY**

**Nucleic acids structure:** DNA as genetic material, Watson-Crick model, A, B and Z forms of DNA; RNA types, distinctions between RNA and DNA. Experimental evidence – Griffith, McLeod, McCarty and Avery, Hershey-Chase experiments. Definition of gene, organization of genes and non-coding DNA in prokaryotes. Eukaryotes- unique, moderately repetitive and highly repetitive DNA sequence, satellite DNA, Cot value

**Unit II DNA REPLICATION**

DNA replication in prokaryotes, mode of replication, Semiconservative modes of replication. An overview of replication – replication eye, replication forks, semi discontinuous replication, Okazaki fragments, RNA primers – Enzymes of replication – DNA polymerases I, II, III, Topoisomerases, Helicases binding proteins and ligases. Role of Telomeres in eukaryotic DNA replication, Inhibitors of replication.

**Unit III TRANSCRIPTION**

Steps in prokaryotic transcription: initiation, elongation, termination, and the factors involved in transcription. Difference between prokaryotic and eukaryotic transcription. Factors involved in eukaryotic transcription. Post transcriptional processes and its importance. Inhibitors of transcription.

**Unit IV TRANSLATION**

Genetic code, degeneracy, codon usage, wobble hypothesis. Ribosome – Prokaryotic and Eukaryotic origin. Steps in translation – Initiation, elongation, termination, and the factors (both Prokaryotes and Eukaryotes) involved in translation, Inhibitors of Translation. Post translational modification: Formation of disulphide bonds, proteolytic cleavage, protein glycosylation – N linked oligosaccharides, O linked oligosaccharides Acetylation and Methylation.

**Unit V DNA Damage and repair**

DNA damage by chemical and physical agents. Mutation – definition, type of mutations (spontaneous, induced and point mutation). Types of repair mechanisms: Base excision repair (BER), Nucleotide excision repair (NER), Mismatch repair (MMR), Double-strand break repair, Non-homologous end joining, Homologous recombination, and SOS repair.

Gene regulation – Lac operon and Tryptophan operon.

**Text Books:**

1. *Cell Biology* by S.C.Rastogi , New Age International Publishers, 3rd edition (2007) (For Unit 1 &2)
2. *Molecular Biology* by Freifelder, Narosa Publishing House, 4th edition, (1999) (For Unit 3,4 &5)

**Books for Reference:**

1. *Molecular Cell Biology* (2007) by Harvey Lodish, Arnold Berk, Lawrence Zipursky, Paul Matsudaira, David Baltimore, James Darnell.
2. *The Cell* by Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, Keith Roberts, and James D. Watson.
3. *Biochemistry* by Zubay 4<sup>th</sup> Edition.
4. *Molecular Biology* by David Freifelder.
5. *Biochemistry and Molecular Biology* by H. Ellicot and C. Ellicot.
6. *Biochemistry and Molecular Biology* by William .H.Elliot, Oxford University Press, 3<sup>rd</sup> edition (2007)
7. *Concepts in Molecular Biology* by S.C.Rastogi , New Age International publishers, 2<sup>nd</sup> edition (2005).



**III YEAR – V SEMESTER  
COURSE CODE: 7BBC5C2**

**CORE COURSE- X – CLINICAL BIOCHEMISTRY**

**Unit I            DISORDERS OF CARBOHYDRATE METABOLISM**

Sugar level in normal blood – Hypo and Hyperglycemia, Renal threshold, Glycosuria, Glucose tolerance test. Diabetes mellitus. Glycogen storage disease- types and characteristics. Galactosemia., Hereditary fructose intolerance. Mucopolysaccharidoses. Inborn errors of carbohydrate metabolism.

**Unit II            DISORDERS OF LIPID METABOLISM**

Hypo and Hyper lipoproteinemias, disorders of triglycerides, Phospholipids and Cholesterol metabolism. Steatorrhea. Gaucher's disease- types and characteristics. Tay-Sachs disease. Niemann-Pick disease. Fabry's disease. Inborn errors of lipid metabolism.

**Unit III          DISORDERS OF AMINO ACID AND PROTEIN METABOLISM**

Amino acid metabolism in starvation, Disorders of plasma protein – globulinemia, proteinuria. urea, uric acid, creatinine, ammonia. Uremia, Ureemia and Porphyria. Maple syrup urine disease. Phenylketonuria. Homocystinuria. Tyrosinemia. Inborn errors of amino acid metabolism.

**Unit IV          DISORDERS OF NUCLEIC ACID METABOLISM**

Gout, Lesch – Nihan syndrome, orotic aciduria, Dihydropyrimidine dehydrogenase deficiency. Dihydropyrimidinuria. Adenosine phosphoribosyl transferase deficiency, Adenosine deaminase deficiency and xanthinuria.

**Unit V            IMMUNOLOGICAL DISORDERS**

Disorders of Immunoglobulin synthesis, allergy (types, causes and physiology) and Hypersensitivity reactions and its types, Autoimmune diseases (Rheumatoid arthritis, Graves disease, Type 1 diabetes, Systemic lupus erythematosus) .

**Text Books:**

1. *Medical Biochemistry* by N.V. Bhagavan, Elsevier Publishers (2002) (For Unit 1 & 2)
2. *Text Book of Biochemistry* by M.N. Chatterjee, Jaypee Publishers (2006) (For Unit 3, 4 & 5)

**Books for Reference:**

1. *Physiological Chemistry* – Hawk's
2. *Practical Clinical Biochemistry* – Harold Varley
3. *Clinical Biochemistry* – Tietz
4. *Biochemistry* – Chatterjee
5. *Practical Clinical chemistry methods and Interpretations* – Chawla
6. *Fundamentals of Biochemistry* by Ambika shanmugam, S.Chand Publishers (1986)

7. *Medical Laboratory Technology by Mukherjee, Tata Mc Graw Publishers*  
(1988



**111 YEAR – V SEMESTER  
COURSE CODE: 7BBC5C3**

**CORE COURSE - XI - HUMAN GENETICS**

**Unit 1      BASICS OF GENETICS AND GENE EXPRESSION**

Introduction to genetics – Scope and significance of genetics, DNA – Types and structures, RNA – Types and functions, gene expression – Eukaryotic transcription – RNA splicing and processing, Overview of translation – mechanism – Post-translational modifications.

**Unit 11     ORGANIZATION OF CHROMOSOMES AND CHROMOSOMAL ABNORMALITIES**

Chromosomes – Structure and Functions, Organization of chromosomes, Chromosome banding, Karyotyping, Chromosomal abnormalities, Sex linked inheritance – Hemophilia, color blindness, Lesch-Nyhan syndrome, Sex chromosome abnormalities – Trisomy X, Klinefelter syndrome, Turner syndrome.

**Unit 111    MENDELIAN PRINCIPLES AND CHROMOSOME MAPPING**

Principle of Genetic Transmission – Mendel's Law of dominance, segregation and independent assortment, Chromosome mapping – Linkage and crossing over – molecular mechanism of crossing over, Mapping with molecular markers – Single nucleotide polymorphisms.

**Unit 11V    TRANSPOSONS, MUTATION AND REPAIR MECHANISMS**

Transposons – Eukaryotic transposable elements – mechanism of transposition – DNA transposons – retrotransposons – transposable elements in human genome (LINEs and SINEs), Mutation – mechanism (base analogs, intercalating agents) and types, DNA repair mechanisms – Photoreactivation – excision repair – SOS repair

**Unit V      POPULATION GENETICS, CANCER AND HUMAN GENOME PROJECT**

Population genetics – Genetic pool – Hardy-Weinberg law of equilibrium – genetic drift and population size, Pedigree analysis, allelic frequency, selection, Cancer genetics – Oncogenes, proto-oncogenes – tumor suppressor genes, Outline of Human genome project.

**Books for Reference:**

1. Human molecular genetics, Second Edition (1999) by Strachan T, Read A.P.
2. Introduction to genetic analysis, Tenth Edition (2012) by Anthony J.F. Griffiths, Susan R. Wessler, Sean B. Carroll and John Doebley.
3. A textbook of Human Genetics (2011) by Amita Sarkar.
4. Genetics- Analysis of genes & genome, Fifth Edition (2000) by D.L. Hartl and E.W. Jones EW
5. Genes 1111 (2004) by Benjamin Lewin
6. Genetics – A conceptual approach, Fourth Edition (2012) by Benjamin A. Pierce
7. Molecular Biology of the Gene, Fifth Edition (2004) by James D Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine and Richard Losick, Benjamin Cummings.

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III YEAR – V / VI SEMESTER  
COURSE CODE: 7BBC6P1

**CORE COURSE- XII – LABORATORY COURSE- III –  
BASIC MICROBIOLOGY AND IMMUNOLOGY**

**(University Examination will be held in sixth semester only)**

1. Separation of Blood and Serum
  - a. Estimation of proteins from serum by Lowry Method
  - b. Determination of albumin and A/G ratio on Serum
2. Estimate the following constituents in Blood and Serum
  - a. Blood Urea
  - b. Blood Sugar
  - c. Blood Cholesterol
  - d. Serum Creatinine
  - e. Serum Inorganic Phosphorus
3. Urine Qualitative Analysis / Normal / Abnormal Constituents
  - a. Estimation of Urea in Urine
  - b. Estimation of Creatinine in Urine
  - c. Estimation of Chloride in Urine
  - d. Determination of titrable acidity in Urine
4. Separation of Plant Pigments by Column Chromatography
5. Separation of serum protein from paper electrophoresis.
6. Preparation of Yoghurt
7. Production of Saukraut
8. Mushroom cultivation.

**Text Books:**

1. Immunology by N.Arumugam, Saras Publications (2009)
2. Immunology by Kubly, Freeman Publishers, 6th edition (2008)
3. Microbiology by N.Arumugam, Saras Publications, (2005)

**Books for Reference:**

1. Immunology by Roit, Wiley Black well publishers, 12 th edition (2009)
2. Immunology by Tizard, Elsevier Publishers, 8th edition (2010).
3. Microbiology by Michael Pelczar, Tata Mc Graw Hill Publications (2010)
4. Madigan et al. Brock Biology of microorganisms 10th ed. Prentice Hall, 2002.
5. Davis et al Microbiology 4th ed. Lippincott Williams and Wilkins, 1989.
6. Joklik et al. Zinsser's Microbiology Mc Graw-Hill Professional, 1995.



**VI YEAR – V / VI SEMESTER  
COURSE CODE: 7BBC6P2**

**CORE COURSE - VIII – LABORATORY COURSE – IV –  
BASIC CLINICAL BIOCHEMISTRY**

***(University Examination will be held in sixth semester only)***

1. *Cleaning of Glassware*
2. *Preparation of Simple Culture Media*
3. *Selection of Suitable Culture Media*
4. *Staining Techniques*
  - a. *Smear Preparation and Fixation*
  - b. *Simple Staining, Grams Staining, Negative Staining and Spores Staining*
5. *Determination of Bacterial Growth curve.*
6. *Isolation of Microbes:- Serial dilution technique and Streak plate technique*
7. *Biochemical Reactions of Bacteria*
  - a) *Starch Hydrolysis* b) *Casein Hydrolysis.*
8. *Estimation of Acidity in milk.*
9. *Microbial quality of milk-methylene blue reduction test.*
10. *ABO Blood Grouping, Rh factor typing, RBC, WBC Count, ESR.*
11. *Estimation of Haemoglobin by Sahle's Method.*
12. *Antigen Preparation.*
13. *Enumeration of Bacterial count on food products.*
14. *Determination of Microbial Quality of Milk.*
15. *Ammonium Sulphate precipitation in protein.*



**III YEAR – V SEMESTER  
COURSE CODE: 7BBCE1A**

**ELECTIVE COURSE - 1 (A) – MICROBIOLOGY & IMMUNOLOGY**

**Unit I ORGANISATION AND STRUCTURE OF MICROORGANISMS**

General characteristics of different groups: Acellular microorganisms (Viruses, Viroids, Prions) and Cellular microorganisms (Bacteria, Algae, Fungi and Protozoa) with emphasis on distribution and occurrence, morphology and mode of reproduction and economic importance.

Prokaryotic organization – Cytoplasmic membrane and their functions – Mesosomes, cell wall – Gram positive and Gram negative bacteria and their reactions, capsule and slime layers– flagella and cilia – bacterial chromosome, plasmids, ribosomes, reserved food – endospore.

**Unit II BACTERIAL NUTRITION**

Growth and reproduction – autotrophic and heterotrophic nutrition – bacteria photosynthesis – chemolithotrophy, bacterial metabolism – fermentation – homofermentative and heterofermentative types – binary fission – other modes of reproduction – conjugation – transformation – transduction – sporulation – kinetics of bacterial growth – normal growth curve.

**Unit III APPLIED, FOOD & INDUSTRIAL MICROBIOLOGY**

Food spoilage, food poisoning and food borne infection. Use of microbes in industries, ethanol production, organic acid (lactic and citric acid) production, antibiotics (Pencillin and Streptomycin) production.

Microorganism and milk: Sources of microorganism, fermentation of milk, specific fermentation of milk souring, gassiness, aroma and flavor, proteolysis, alkali production, ripeness, sweet curding, bitter flavour and miscellaneous fermentations.

**Unit IV IMMUNOLOGY**

Introduction to cells and organs of the immune system. Immunity (Innate, Acquired), antigen (Immunogen, Hapten, T-cells dependent and independent antigens), antibodies (types and structure), host resistance. Antigen – Antibody interactions: Affinity and Avidity, Epitope, paratope, Idiotypes. Vaccines. Immunodiagnosics – ELISA and RIA, immuno Electrophoresis

**Unit V COMPLEMENT SYSTEM AND TRANSPLANTATION IMMUNOLOGY**

**Components of the Complement system;** Activation pathways (Classical, Alternative and Lectin pathways); Biological consequences of complement activation

**Transplantation –** Organization of MHC locus (Mice & Human); Structure and Functions of MHC I & II molecules. Graft rejection, transplantation antigens, HLA and mechanism of graft rejection and tissue typing. Prevention of graft rejection – immuno suppressive agents and immuno surveillance.



**Books for Reference:**

- |  |   |                                 |
|--|---|---------------------------------|
| 1. <i>Microbiology</i> (5 <sup>th</sup> Edn)                   | – | <i>Michael J. Pelezar</i>       |
| 2. <i>Microbiology</i>   | – | <i>Engene W. Nester Roberts</i> |
| 3. <i>Microbiology</i>   | – | <i>Pelzar and Reig</i>          |
| 4. <i>Immunology</i>   | – | <i>Janis Kuby</i>               |
| 5. <i>Immunology</i>   | – | <i>Eli Benjamini</i>            |
| 6. <i>Cellular and Molecular Immunology</i><br><i>Lichtman</i> | – | <i>Abut K. Abbas &amp; A.K.</i> |
| 7. <i>Immunology</i>   | – | <i>Richard M. Hyde</i>          |
| 8. <i>Immunology</i>   | – | <i>Goldsby</i>                  |
| 9. <i>Introduction to Microbiology</i>                         | – | <i>Ingraham.</i>                |



**1<sup>st</sup> YEAR – V SEMESTER  
COURSE CODE: 7BCE1B**

**ELECTIVE COURSE - 1 (B) – DIAGNOSTIC BIOCHEMISTRY**

**Unit 1**

*Clinical chemistry tests- Blood group, glycosylated haemoglobin, fructosamine, GTT, uric acid, Ca, P, Fe, Cu, CSF analysis.*

**Unit 11**

*Enzymes: Acid phosphatases, LDH, CPK, CPK\_MB, Alpha amylase, Hormones - T3, TSH, LH. Immunoglobulins- IgA, IgM, IgE.*

**Unit 111**

*Serodiagnostic procedures- precipitation tests, VDRL test, Vidal test, (Slide and tube method) Brucella agglutination test, ASO test, RA test, CRP test. Complement fixation test, skin test- Montaux test, Lepramin test.*

**Unit 11V**

*Complete haemogram, complete urine analysis, complete motion analysis, semen analysis.*

**Unit V**

*Blood bank, blood group and Rh factor, Coomb's test, Coagulation studies, Prothrombin test (PT), Partial PT, Plasma fibrinogen. Test for amino acidurias- Test for phenyl ketonuria, DNPH, Test for keto acids, sodium nitroprusside test for Cystinuria and homocysteine.*

**Books for Reference:**

1. Varley.H (1985), *Practical Clinical Biochemistry*, 7<sup>th</sup> Edition
2. Tietz. N (1982), *Fundamentals of Clinical Chemistry*, W.B. Saunders Company
3. Jacques Wallach (1982), *Interpretation of Diagnostic test – A Synopsis*, 1<sup>st</sup> Edition, Little Brown and Company.
4. Jone Zilva & Pannall.P.R. , *Clinical Chemistry, Diagnosis and treatment*, PG Publishing Pvt. Ltd.





**1<sup>st</sup> YEAR – VI SEMESTER  
COURSE CODE: 7BBC6C1**

**CORE COURSE - XIU – NUTRITION BIOCHEMISTRY**

**Unit I INTRODUCTION TO FOOD SCIENCE**

Definition of foods and nutrition. Functions of food and its relation to nutritional and clinical health, Basic food groups: Energy giving foods, body building foods and protective foods. Essential nutrients, RDA for average Indian, analysis of food composition, food habits, food fads and fallacies.

**Unit II ENERGY**

Definition and unit of energy – Kcal, RQ, SDA. Basal metabolism, measurement of BMR, factors affecting BMR, regulation of body temperature, energy needs, total energy requirements, estimation of energy requirements and energy value of foods.

**Unit III MINERAL AND VITAMIN NUTRITION**

Essential micro and macro nutrients, distribution, sources, functions and abnormalities.

Vitamins: Definition, classification, sources, distribution, metabolism, function, abnormalities, minimum requirements and optimum allowances, assay of vitamins, deficiency and excess.

**Unit IV BALANCED DIET FORMULATION**

Assessment of nutritional status. Nutrition at various stages of growth and development: Diets for infants. Children, adolescent, pregnant women, lactating mothers and older persons. Nutritional therapy during stress, anemia, obesity, diabetes mellitus and allergy Protein nutritional Nitrogen balance, quality of food proteins and requirements, protein nutrition abnormalities, protein deficiency disorder, PEM

**Unit V NUTRITIONAL DISORDERS**

Nutritional challenges of the future: Food production and food storage, future foods, new protein foods, new fat foods and changing food habits.

**Text books:**

1. Nutrition and Dietetics by Shubhagini, Tata Mc Graw Publishers, 3rd edition, (2010) (For Unit 1,2 &3)
2. Human Nutrition by B.Srilakshmi, New Age Publishers, 2nd edition (2008) (For unit 4&5)

**Books for Reference:**

1. Principles of Nutrition Determination Dietetics – Dr. M.S. Swaminathan
2. Advances Text Book on Food and Nutrition – Dr. M. Swaminathan Vol. 1 & II
3. Normal and Therapeutic Nutrition – Corine Robinson
4. Human Nutrition and Dietetics – Garon and James
5. Food Science by B.Srilakshmi, New Age Publishers, 5<sup>th</sup> edition (2010).



**1<sup>st</sup> YEAR – VI SEMESTER  
COURSE CODE: 7BBC6C2**

**CORE COURSE - XV – PLANT BIOCHEMISTRY**

**Unit I PLANT CELL PHYSIOLOGY**

Structure and biochemical aspects of plant cell membrane, primary and secondary cell walls, cell plate, plasmodesmata, vacuoles, meristematic cells. Water balance and transport in plants, osmosis and diffusion, water potential, measuring of water potential, osmotic potential, membrane potential, diffusion pressure deficit, solute transport, mass flow, transpiration.

**Unit II PLANT NUTRITION**

Essential mineral nutrients – Absorption, translocation and function, effects of toxicity and deficiency, N<sub>2</sub> cycle, Nitrogen fixation – symbiotic and a symbiotic nitrogen fixation – nitrogenase, nitrate assimilation, sulphur metabolism sulphate as a mineral nutrient, sulphate assimilation

**Unit III PHOTOSYNTHESIS**

Structure & function of chloroplast system. Photosynthetic pigments and their functions, Photo system I & II. Photosynthetic electron transport and photophosphorylation. Calvin cycle (C<sub>3</sub> plants), Hatch slack pathway (C<sub>4</sub> plants).

**Unit IV PLANT GROWTH REGULATORS**

Normal growth hormones – Auxins, GA, Cytokinins, Ethylene and Abscisic acid synthetic growth hormones.

**Unit V PLANT PHYSIOLOGY AND REPRODUCTION**

Physiology and reproduction: Brief account on physiology of germination / dormancy / photoperiodism / Vernalization.

Plant tissue culture (an elementary treatment)

Biochemistry of disease resistance in plants.

**Text Books:**

1. Plant physiology by M.Devlin, John Wiley Publications, 3rd Edition (1996)  
(For Unit 1)
2. Plant Physiology by S.N .Pandey, Vikas publishing House, 4th Edition (2008)  
(For Unit 2)

**Books for Reference:**

1. Plant Biochemistry – Devlin and Witham
2. Plant Biochemistry – Ross and Salisbury
3. Plant Biochemistry – (3<sup>rd</sup> Edn) – Bonner and Varner
4. Plant Physiology – Hopkins
5. Biochemistry (4<sup>th</sup> Edn) – Geoffrey Zubay



**111 YEAR – VI SEMESTER  
COURSE CODE: 7BBCE2A**

**ELECTIVE COURSE - 11 (A) – BIOTECHNOLOGY**

**Unit 1 VECTORS**

*Plasmids and Cosmids, Types of vectors – Bacterial, Viral, Yeast and Plant vectors, Yeast artificial chromosomes and Bacterial artificial chromosomes, Agrobacterium plasmids. Expression and Integration vectors, Enzymes involved in cloning.*

**Unit 11 RECOMBINANT DNA TECHNOLOGY**

*Cloning strategies, cDNA Synthesis and Genomic library, Restriction enzymes and Digestion, Gene mapping, Restriction fragment length polymorphism, SSCP, Polymerase chain reaction, Sequencing methods, Marker genes, site directed mutagenesis, Tag sequences (His tag)*

**Unit 111 GENE TRANSFER TECHNOLOGY**

*Types of Gene transfer methods – Electroporation, Microinjection, Biolistic method, transformation using PEG & Calcium, Viral transfection, Protoplast fusion, Ti plasmid mediated gene-transformation*

**Unit 111 ANALYTICAL TECHNIQUES**

*Qualitative and Quantitative analysis of DNA, RNA and Protein, Spectroscopy and Spectrophotometric analysis, Electrophoretic assay and Blotting techniques, DNA finger printing and RAPD*

**Unit V APPLICATIONS OF GENETICALLY MODIFIED ORGANISMS**

*Production of Transgenic plants, animals and microorganisms, Blood products, Food products, Merits and Demerits of GMOs.*

**Text Books:**

1. *Biotechnology by U.Sathyannarayana, Allied Book publications, 2nd edition (2006) (For Unit 1, 2 & 3)*
2. *Animal Biotechnology by U.Kumaresan, Saras Publications, (2009) (For Unit 4 & 5)*

**Books for Reference:**

1. *Molecular Biotechnology, Bernard R. Glick and Jack J. Pasternack. 11 edition ASM press.*
2. *Recombinant DNA by Waston et al., (1992) Scientific American Books.*
3. *Principles of Gene manipulation by R.N. Old and S.B. Primrose (1994) Blackwell scientific publications.*
4. *Concepts in Biotechnology, Eds D. Balasubramanian et al., (1996) University press.*
5. *Internet search should be made for journals for the latest information.*
6. *Biotechnology by R.C.Dubey, S.Chand Publications (2009)*
7. *Biotechnology by S.S.Purohit, Saraswati Publishers (2005)*



**1<sup>st</sup> YEAR – VI SEMESTER  
COURSE CODE: 7BBCE2B**

**ELECTIVE COURSE- 11 (B) - DRUG BIOCHEMISTRY**

**Unit 1**

*Introduction and receptor concept; Introduction to drugs, Classification of drugs, Passage of drugs across biological membrane; Absorption and distribution of drugs; Binding of drugs to plasma proteins.*

*Drug receptor interaction, Binding forces in drug receptor interaction, types of receptors, receptor theories, isolation of receptors, consequences of drug receptor interaction.*

**Unit 11**

*Drug metabolism and elimination; Drug metabolism, methods of studying drug metabolism- microsomal drug metabolism, metabolism via hydroxylation, conjugation, deamination, N- oxidation, azo & nitro reduction, non-microsomal oxidation, oxidative deamination, purine oxidation, dehalogenation, hydrolysis, action of choline esterase. Elimination of drugs from the body with reference to renal system.*

**Unit 111**

*Chemotherapy; mode of action of sulfonamides, anti-metabolites of folate, purines and pyrimidines. Anti- bacterials- mode of action and resistance to penicillin, streptomycin, tetracycline and chloramphenicol. Anti viral, anti malarial and anti-TB drugs.*

**Unit 11V**

*Drugs acting on CNS and Cardio-vascular system. CNS structure and mode of action of barbiturates, salicylates, MAO inhibitors and drugs for Parkinson's disease.*

**Unit V**

*Immunity to bacteria and viruses. Skin test; Mantoux and penicillin test. Resistant to tumors; NK cells; Tumour immune therapy; lymphoid tumours. Vaccination; passive and active immunization; Recombinant vaccines; DNA vaccines. Benefits and adverse effects of vaccination. CD4 cell count in HIV infection.*

**Books for Reference:**

1. *Immunology- An introduction, Tizzard R Jan, 1995.*
2. *Immunology- Roitt Ivann, Jonanthan Brastoff and David Male. 1993.*
3. *Text book of microbiology- Ananthanarayanan R and Yayaramman Paniker, 1996.*
4. *Immunology- Janis Kuby, 3<sup>rd</sup> edition.*
5. *Text book of pharmaceutical chemistry – Mohammed Ali CBS Publishers and Distributors, New Delhi, 1995*
6. *Pharmacology, An introduction to Drugs, Prentice Hall Inc, Eaglewood Clif, New Jersey, 1994.*



7. *Pharmaceutical chemistry- G.R. Chatual, Vol 11, 1<sup>st</sup> editin, Himalaya Publishing House, Bombay, 1991.*



**111 YEAR – VI SEMESTER  
COURSE CODE: 7BBCE3A**

**ELECTIVE COURSE- 111 (A) – BIOSTATISTICS & BIOINFORMATICS**

**Unit 1            COLLECTION AND ORGANIZATION OF DATA**

*Collection of primary data and secondary data. Methods of data collection. Sampling and sampling designs – meaning and definition of random and non-random sampling.*

*Editing of data, Definition for editing, objectives of editing, problems of accuracy, problems of approximation and errors.*

**Unit 11            REPRESENTATION OF DATA**

*Classification of Data, Meaning and Definition, objectives of classification of data.*

*a) Ungrouped data – continuous – discrete variation.*

*b) Univariate frequency distribution, continuous frequency distribution, discrete frequency distribution.*

*c) Cumulative frequency distribution*

*Tabulation of data: Meaning and definition (a) parts of a table (b) Advantages. Diagrammatic and graphic representation of data.*

**Unit 111**

*Explanation, Types of dispersion: 1. Range 2. Mean deviation 3. Standard deviation and variance, Problems related to the above mentioned dispersion taking ungrouped data.*

*Explanation and definition for symmetry, explanation for skewness, kurtosis of different types of moments. Tests of skewness, Measures of skewness, measures of Kurtosis (Problems not necessary).*

**Unit 111**

**a) Basics of Computer**

- ❖ *Course introduction, MS Windows basics, Unix basics*
- ❖ *PC Xwindows (NCD PCXWARE)*
- ❖ *File management*
- ❖ *E-mail (PTNE, EUDORA, METSCAPE MAIL)*
- ❖ *File transfer (ftp, wsftp)*

**b) Review of key molecular genetic internet site and searching for similar sequences**

## **and multiple sequence alignment**

- ❖ *Internet world wide web resources (a list and description is provided in some useful sites on the internet)*
- ❖ *Similarity searching BLAST/FASTA*
- ❖ *Retrieving and installing a program (Tree Tool)*
- ❖ *Multiple sequence alignment (CLUSTLAW and bee)*

## **Unit V**

### **a) The virtual library**

- ❖ *Searching MEDLINE on the pubmed system from the center for biotechnology information.*
- ❖ *Searching the Science Citation Index and current contents connect from the institute for scientific information.*
- ❖ *Using bibliographic databases and tables of content services to stay current of the biomedical literature.*
- ❖ *Accessing full – text journals on the internet and printing articles.*

### **b) Databases and search tools**

- ❖ *NCBI: <http://www.ncbi.nlm.nih.gov/>*
- ❖ *EMBL SERVER: <http://www.ebi.ac.uk/services.html>*
- ❖ *Genom Navigator: S. cerevisiae Genome index*
- ❖ *<http://www.mpimg-berlin-dahlem.mpg.de/andy/GN/S.cerevisiae>*

### **Books for Reference:**

1. *Statistical Methods – S.P. Gupta*
2. *Biostatistics – A foundation analysis in health Science – Daniel*
3. *Form and Style in thesis writing health science – Cambhell*
4. *Thesis and Assignment Writing health science – Anderson*
5. *Research Methodology health science – R.C. Kothari*
6. *Genomic Perl – From Bioinformatics Basics to working code – Rex A. Dwyer*
7. *Fundamentals of Biostatistics – Rosner*
8. *Bioinformatics Sequence and Genome analysis – David W. Mount*
9. *Bioinformatics Methods and Protocols – Stephen Misener*
10. *Bioinformatics (2<sup>nd</sup> edition) – Baxe vanis*



**111 YEAR – VI SEMESTER  
COURSE CODE: 7BBCEPR**

**ELECTIVE COURSE - 111 (B) – MINI PROJECT**

*\*\* Interested candidates will be allowed to do mini project at reputed colleges / Universities / Industries for a period of 20 – 30 days instead of elective course. The Viva-voce examination will be conducted by Internal staff only*

